

## Math 102 — Exam 1 review

Your exam in class on October 7 will contain about 6 problems, some with multiple parts. It will cover material from Homework 0 to Homework 3. The problems below give you a sampling of some similar problems, but it's not necessarily comprehensive, so make sure to review old homework, worksheets, and lecture notes. There are also problems in our textbook, with answers to odd-numbered problems in the back. No notes will be allowed on the exam, but you can use a scientific calculator with no graphing functionality.

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**Problem 1.** First, consider  $a_n$  below as the  $n$ th term of a sequence. State whether the sequence converges and, if so, find its limit. Second, consider  $a_n$  as the  $n$ th term of a series. State whether the series converges and, if possible, find its sum.

a.  $a_n = \frac{n^3 + 4n^2 + 3}{8n^4 + 5n + 7}$

b.  $a_n = \frac{9^{n+1}}{10^n}$

c.  $a_n = (-1)^n \frac{n^4 + 1}{3n^4 + 4}$

d.  $a_n = n^2 2^{-n}$

**Problem 2.** Find the sum of the infinite series

a.  $-3 + 2 - \frac{4}{3} + \frac{8}{9} - \frac{16}{27} + \dots$

b.  $\sum_{n=1}^{\infty} 6(0.9)^{n-1}$

c.  $\sum_{n=1}^{\infty} \frac{(-3)^n}{4^n}$

**Problem 3.** Maintenance on a new car starts at \$500 by the end of the first year of ownership but increases by 20% annually. Find the total maintenance cost after 15 years of ownership.

**Problem 4.** Determine whether the series  $\sum_{n=1}^{\infty} a_n$  converges where  $a_n$  is given below. State the test used and make sure to justify your use of the test with appropriate details.

a.  $a_n = \frac{1}{n\sqrt{n^2+1}}$

b.  $a_n = \frac{n!}{5^n}$

c.  $a_n = \frac{n}{3n+1}$

d.  $a_n = (-1)^n \frac{1}{5n^2+1}$

e.  $a_n = (-1)^{n-1} \frac{1}{\sqrt{5n^2+1}}$

f.  $a_n = \frac{3}{n+(1.2)^n}$

g.  $a_n = \frac{2^n n!}{(n+2)!}$

h.  $a_n = \frac{n^{0.1}-1}{n(\sqrt{n+1})}$

**Problem 5.** Determine whether the following series converge absolutely, converge conditionally, or diverge.

a.  $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{n^2}{n^5+2}$

b.  $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{\sqrt{5n+2}}$

c.  $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{n^{1/3}+3}$